Physical Factors of the Historical Process

by A. L. TCHIJEVSKY*

Editor's Note: Even though research on the correlation between physical reactions of organisms to environmental fluctuations has progressed to investigations of less obvious phenomena than sunspots, this paper remains a landmark in the literature. The data and the tools have both been developed far beyond the state that obtained when Professor Tchijevsky wrote this paper, but as yet no conclusive case—pro or con—has been developed. Extensive work has been done on sunspots as well as on human excitability, but the task of establishing any relationship of the two remains one of the more important unfinished projects.

Our previous publication of this paper is out of print; it is reprinted here in response to numerous requests. *G.S.*

FOREWORD

At a time when serious attention is being concentrated on the study of economic and political laws, the study of the influence of natural factors on the mass of behavior of humanity has perhaps been rather neglected.

The object of this paper is to present a condensed abstract of the work of the Russian Professor, A. L. Tchijevsky, dealing with the influence of Sunspot Activity upon the whole historical process.

Holding no personal brief for the theories of Professor Tchijevsky, I tried only to be as exact as possible in my translation of his work. *Vladimir P. de Smitt*

INTRODUCTION

In reviewing human history, it is found that even the most prominent intellects have been powerless, except in rare instances, to foretell even the immediate future of their nations or countries or the outcome of wars and revolutions.

Historical events have always indicated different results than those which were anticipated at their beginning.

Humanity has never formulated any law which would govern any particular historical facts or sequence of facts throughout the many centuries of its culture, despite the gradual and progressive development of precise sciences. The bases for the destinies of History seem chaotic and the allotment of events in space and time seems unruled by any law.

Under this conception were equally regarded short periods of History with separate events (wars, revolutions, etc.) and whole epochs of hundreds and thousands of years covering whole cultures and civilizations of humanity.

The comparative method adopted quite recently in the study of History consists essentially in detecting the general course of development of different historical events and in discovering the exact laws pertaining to the event.

Students of History proved that individual cases of more or less similar character, and long historical epochs have many similar traces in their progressive development; in other words, the events of History repeat themselves and this makes possible the deduction of certain generalizations (K. Lamprecht, O. Spengler). J. de Condorcet (1743–1794) in his famous work "Esquisse d'un Tableau Historique des Progress de l'esprit humain" emphasized the establishing of a hypothetical history of the people by depicting facts from the histories of all nations and their mutual relations.

History was justly known up to the present as Knowledge, not as Science. This opinion was given by Arthur Schopenhauer (1788–1860) in his "Die Welt als Wille und Vorstellung." De Fontainaille in XVIII Century called History a "convenient tale" (L'histoire n'est qu'une fable convenue).

Undisputably, the first and principal property of Science is the presence of definite Laws governing the facts in all their integral parts.

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This paper was translated and condensed by Vladimir P. de Smitt when he was Research Associate, Geology, Columbia University and Senior Research Analyst, Library of Congress. The paper was presented at the annual meeting of the American Meteorological Society in December 1926.

Inefficiency in finding out the laws of History makes some people assume the hand of Providence guiding the destinies of men, others see that chance and accidental facts with no general law are essential in History and yet others regard the human will as the principal factor changing the flow of historical events, whereas the acts of this will never could be accounted for nor classified.

Many branches of human knowledge in the XIX and XX Centuries made such progress that they became indispensable and obviously necessary in the practical every-day life of men. But what do we owe to History?

A man who would speak of the "practical purposes in History" would be called irrational.

Notwithstanding the enormous amount of historical material collected, the best and finest methods adopted for studying it, the colossal work done by scientist-historians: History at its present level gives to humanity nothing of social-practical value.

History presents knowledge of material already dead and useless for the ever progressive life. It presents archives where researches are seldom made, to answer the questions of the present day; the "lessons of History" have taught nothing to anyone, and even those with intimate knowledge of History made the same mistakes that had already been made years before.

Thus, not until the time when man ceases to repose only in providential guidance in the progress of History, and no longer regards the constantly changing unstable human will as a predominant factor, will he be able to advance in search of laws which govern his daily activity as well as his centuries old destinies.

The fact must be noted that the sphere of exact disciplines of Science never touched History in its entirety, even when they were brought into the domain of psychology, and physico-mathematical laws were admitted to govern the processes of sensation.

The English historian, H. T. Buckle (1821–1862), equipped with the richest data accumulated by science in the domains of History, Geography, Economics and Statistics, made an endeavor in his work "History of Civilization in England," to show that the principles and methods of natural sciences must be applied to History, because History is a reciprocal reaction between man and nature.

Nearly at the same time, the American chemist and historian, J. M. Draper (1811–1882) in his outstanding "History of The Intellectual Development of Europe" (1856), proposed the idea that the historical evolution of peoples is being governed by natural laws and is under the influence of the physical agents of nature.

But these endeavors were fruitless because of the existing general opinion of the independence of the psychical and social activities of man from any physico-chemical factors in the world of surrounding nature.

Contemporary sciences try to bring all psychological phenomena to physiological processes in which they seek and find a physico-chemical basis: the mechanics of the elementary particles in the nerve centers.

The success of biophysics during recent years begins to deprive man and his higher nervous activity of the mysterious halo which surrounded them during so many thousands of years.

The physico-mathematical analysis when applied to the investigation of psychical processes, shows that their functions can be expressed in physico-chemical reactions and explained by mathematical formulae.

Considering the psychical activity of man to be in the domain of ordinary natural phenomena, contemporary science similarly supposes a certain dependence to exist between the manifestation of man's intellectual and social activities and a series of powerful phenomena of surrounding nature. The earth, taken as a whole with its atmo, hydro and lytho spheres and also with all the plants, animals and the whole human kind,–the biosphere–must be considered by us as one common organism.

From this viewpoint, it must be admitted, *a priori*, that the greatest events in human societies enveloping entire races through participation of great masses of population must occur simultaneously with some variations or alterations in the forces (factors) of surrounding nature.

Professor Tchijevsky undertook a research of the successions of historical events with relation to the periodical activity of the sun. The results of this research are presented by him in his "Investigation of The Relationship Between The Sunspot Activity and The Course of The Universal Historical Process from the V Century B.C. to the Present Day."

By the "universal historical process," Professor Tchijevsky means the simultaneous course of social evolution in all groups of human society, dependent or independent of each other according to their geographical location. In using this term, he touches to some extent upon the age-old tendency to view History as one unified whole. Thus, in the Second Century B.C., the Greek historian Polibios and eighteen centuries later Bishop J. Bossuet (1627–1704) emphasized the necessity of acquiring a uniform and universal standpoint for historical study.

Bossuet in his "Discours sur l'Histoire Universelle" (1681) says that in full analogy to one common geographical chart which generalizes all countries and all nations, a uniform point of view upon History would help fusion of the histories of various national developments into one unique process–a universal history of humanity.

I ACTIVITY AND GENERAL INFLUENCE OF THE SUN

The sun is an enormous generator of electric energy and emits it in the form of radiation and induction. The sun is surrounded by an electro-magnetic field, the limits of which reach beyond the farthermost planet Neptune, and therefore the earth with its electro-magnetic field is in the sun's field of tremendous power.

The inner life of the sun undergoes rhythmical periodical fluctuations which are manifested on its outer surface by the appearance and disappearance of sunspots, by their number and by other facts.

This characteristic of the sun undergoes regular periods of minimum, increasing, maximum and of decreasing activity.

The entire cycle of the sunspot activity comprises from seven to sixteen years (more often from nine to thirteen years). This periodicity was first discovered by H. von Schwabe (1851). The average length of this period was established later and equals eleven years, thus repeating itself nine times in a century.

Greater and smaller periods have been also found and calculated by several scientists: De Mairan (1746), A. P. Gansky, A. Schuster (1906), Dr. Elsa Frenkel (1913), H. Turner (1913), Bruckner and others.

The complication of the question and the diversity of opinions obliged the author to make inquiries at the best observatories concerning the latest works in this field (Mount Wilson Solar Observatory in Pasadena–Dr. Seth B. Nicholson, Eidgenossische Sternwarte in Zurich–Professor A. Wolfer, Royal Observatory at Greenwich–Professor F. W. Dyson, Steward Observatory in Arizona–Dr. A. E. Douglass, and others.)

By classifying the answers, the one undoubtedly established period is the eleven year period but certainly there exist other periods which have not yet been sufficiently studied owing to lack of material.

The activity of the sun expresses itself in spots, prominences, filaments, foculae, corona, etc., but a special interest must be attached to sunspots which are directly connected with the construction of the sun itself.

As is well-known, the spots appear in two belts on the surface of the sun and cross the sun's disc in thirteen-fourteen days corresponding to the period of rotation of the sun. Some spots reappear a second time within thirteen-fourteen days after their disappearance.

Many observations of sunspots have been made by many scientists (Galilei, Herschel, Zoller, Faye, Secchi, Moreux) and several hypotheses were worked out; nevertheless, the mystery of the spots is not yet solved.

The conspicuous work in this field must be credited to the American scientist, George Ellery Hale* and the French scientist, H. Deslandres. Hale made the assumption that sunspots are huge electrical whirls. Rowland, Young, Zeeman, showed the slitting of bifurcation of spectral lines in a magnetic field which in the case of the sun proves the existence of a magnetic field in the sunspots.

Therefore, it can be assumed that the spot is an enormous magnet with one pole turned toward the earth and the other lying deep in the sun's interior.** Evershed and St. John noticed movements in the spots ("solar vortices" according to Hale).

During the period of the maximum of the sun's activity, all the sun's phenomena acquire tremendous dimensions. The sun ejects streams of anode and cathode rays which ionize the earth's atmosphere (Birkeland, Arrhenius, Nordmann, Paulsen, Villards) and create certain physical effects.

It is to be noted that the greatest perturbations of the earth's magnetism always coincide with the time of passage of large spots through the central meridian of the sun (Loomis, Lord Kelvin, Terby), and according to Ricco, lagging for about two days after this passage.

Some physical effects of sunspot activity, on the earth, which are definitely proved, or under probation at present, are the following:

Magnetic Storms (Sabine, Wolf, Gautier-1852)
Aurora Borealis (Fritz-1853, Loomis)
Cirrus, Cirro-stratus, Cirro-cumulus clouds (Klein, Paulsen)
Halos in the Atmosphere
Fluctuations of the Atmospheric Electricity (Chree, Bauer)
Thunderstorms (Hess, Herbiger, Sviatsky)
Tropical and Extra-tropical Cyclones, etc. (Meldrum)
The Color of the Sky (Busch)
The Temperatures of the Air at the Earth's Surface (Koppen, Nordmann, Mielke-1913).
Surface Tempratures of Some Oceans (Atlantic off Norway)
Polar Icebergs
Precipitation (Symons, Moreux, and others)
Atmospheric Pressure (Walker, Leist, Fedoroff)
Fluctuations of Climate (Bogolepoff)
Earthquakes

The parallelism of three curves, that of the sunspot activity, of the activity auroras and of the fluctuation of the earth's magnetism, must be noted.

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*Probably the latest works of Professor Huntington were unknown to Professor Tchijevsky due to the political conditions. (V. de S.)
**It is now known that sunspots usually occur in pairs of opposite polarity. It is as if they were the ends of horeshoe mag. netc buried in the sun. Ed.

The general influence of the sun on the development of organic life has been observed with greatest interest since ancient times by many philosophers and thinkers. In his present study, the author will begin with the sun's general influence and then gradually proceed to the specific influence.

Men have always felt their dependence of the sun and consequently it is not surprising that the sun has been worshipped as the chief god: Hindoo - Suria and Savitar; Persian - Ormusd; Assyrian - Isdubar and Nimrod; Babylonian - Marduk; Egyptian - Osiris, Ptha, Ra; Ancient Greeks - Apollo, Helios, Febos; etc.

Thus, the doctrine of the activities of the ever-vivifying central fire which has been regarded as the origin of all living, occupies the first place in all mythologies, philosophies and arts.

Even in remotest ancient times, thinkers tried to find correlation between the condition of human organism and the fluctuations of surrounding physical nature which in a certain way depend upon the sun. (Herodotes, Hypocrates, Aristotle, Strabon, Plinius).

From the point of view of contemporary science, all the various and different phenomena: the chemical transformations in the earth's crust, the dynamics of the planet itself and its atmo, hydro and lytho spheres take place under the direct action of the sun. On the equator, all chemical processes are of the maximum activity.

Therefore, there exist certain chemical zones on our planet (Fersman) and corresponding special zones in the soil (Dokoutchaeff).

The direct influence of the sun's energy on the green of plants is well known; it helps the transformation by the plants of inorganic matter into organic. The red rays of the sun's spectrum dissociate carbon dioxide and synthesize carbo-hydrates (K. Timiriazeff 1920).

The influence of the sun upon live organisms cannot be formulated by contemporary science in one universal formula, and therefore the effects of sunlight upon the different components of a living organism must be enumerated.

For example, ultra violet rays affect the oxidating processes in the cellular tissues (Quincke) and increase the exchange of gasses in the living muscular and nervous tissues (Moleschott, Fubini).

This influence of the sun on human organism results in chemical changes in the pigment of the skin, in the changing of the heart-beat, in the alterations in the chemical composition of the blood and the latter results in changes in the general condition of the organism and its nervous tonicity (Lenkei, Behring, Hasselback, Nogier, Aimes, Rollier, Revillet, Marques, d'Oelsnitz, Robin, Moleschott, Loeb, I. Newton, Professor Bechtereff, Lombroso).

The influence of the sun on the climate explains the existence of zones of highest and lowest races and cultures. Therefore, the forces of external nature liberate or bind man's spiritual energy which is in a potential state and thus make the intellect function or become stagnate.

If the different amount of the sun's energy received by different climatic zones has such a great influence on humanity, the question arises: do the periodical changes of the sun's activity resulting in the amount of the emitted innumerable streams of electrical particles and electro-magnetic waves also have an influence upon humanity?

II SYNCHRONOUS CORRELATION OF THE SUN'S PERIODICAL ACTIVITY AND THE PERIODICAL CHANGES IN THE UNIVERSAL HISTORICAL PROCESS

Researches were made in the works of:

Christian Horrebow (1718–1776) Danish Astronomer; Sir William Herschal (1738–1822) English Astronomer; W. S. Jevons (1835–1882) English Economist (his "Commercial Crises and Sunspots"); Koppen; N. C. Flammarion and Thoman Moreaux - French Astronomers; Professor A. E. Douglass of Stewart Observatory ("Climatic Cycles and Tree Growth"); D. O. Sviatsky and Professor V. M. Bechtereff - Russian Scientists; Rudolf Wolf - German Scientist ("Sonnenfleckenliterature" - 1856); and many others.

Since the year 1610, sunspots have been observed by means of telescopes. For the epochs prior to 1610, these spots were mentioned in Chinese annals, in some ancient Arabian, Russian, Armenian documents, in the public chronicles of some European cities (Chroniken der deutschen Stadte); and these sources helped the author to approximately define the periods of maximum activity of the sun beginning with the first-mentioned Chinese observations in the year 188 A.D., but of course these earlier observations lack any system and show great intervals, some of several decades.

A table of forty-five Chinese observations taken from the aforementioned annals for the period of 301–1205, was computed and published by the Japanese Astronomer, Shin Hiragama (Observatory 1889).

From the initial steps in these researches, the author was impressed by a most surprising fact: the fluctuations of the historical process are synchronous with the fluctuations in the physico-chemical processes in the sun's substance. Further investigation showed that notwithstanding the fact

that the mass human life never ceases even for a second in this or any part of the globe, its fullest development nearly covering the entire surface of the globe is attained at the times of maxima of sunspot activity.

The most difficult thing for the author was to adopt a uniform unit for measuring the statistics of the activities of human masses. Here were to be considered two factors: quality of the event (its importance) and quantity (number) of human masses participating.

Other factors such as the length of the event, the area occupied by it, etc., handicapped the formulation of the unit.

It was necessary to find out a generalizing method; i.e., such a method as would be applicable for recording any historical event. For this purpose, Professor Tchijevsky adopted the following moments of every mass event which had a more or less important historical value.

(1) The beginning of the event; i.e., the first rising of masses, and
(2) The moment of the highest tension (if such a moment can be strictly defined).

Greatest attention was paid to the dates of the starting of historical events; i.e., the dates of the first rising of human masses for attaining a certain cause.

The final deductions were arrived at after a long study of detailed statistical researches in the histories of 72 countries and nations of the world; these histories having been known to science from 500 B.C. to 1914, in other words, for 2414 years. The countries and nations involved in this study, were

IN EUROPE

Greece	Switzerland	Spain	Denmark
Rome	Hungary	Ireland	Poland
Italy	Austro-Hungary	Scotland	Bulgaria
Germany	Turkey	Holland	Serbia
Gaul	Rumania	Netherland	Czechia
France	Russia	Norway	etc.
Iberia	Lithuania	Sweden	

IN ASIA

China	Central Asia	Ceylon
Tibet	Hunns	East-Roman Empire
Mongolia	India	Turkey
Japan	Indo-China	Persia
Korea	Asiatic Russia	Palestine-Israel
Indonesia	Afghanistan	And other ancient
Siberia	Arabia	people

IN AFRICA

Egypt	Congo	Morocco
Carthage	Sudan	Other African people
Mauritania	Abyssinia	European Colonies, etc.

IN AMERICA

Canada	Texas
United States	Mexico
California	Peru
Brazil	European Colonies etc.

IN AUSTRALIA

European Colonies	Oceania	Tasmania

For the purpose of studying the histories of these peoples, countries and states, all works and text books, (available under present conditions) in modern and ancient languages were consulted. This research permitted the author to state the following principal facts which characterize the course of the universal historical process, and which are based on numerical statistics.

1. As soon as the sunspot activity approaches its maximum, the number of important mass historical events, taken as a whole, increases, approaching its maximum during the sunspot maximum and decreasing to its minimum during the periods of the sunspot minimum.

2. In each century the rise of the synchronic universal military and political activity on the whole of the earth's territory is observed exactly nine times. This circumstance enables us to reckon that a cycle of universal human activity embraces eleven years (on the average).

3. Each cycle according to its historical psychological signs is divided into four parts (periods):

I.	Minimum of excitability	. . . 3 years
II.	Growth of excitability	. . . 2 years
III.	Maximum of excitability	. . . 3 years
IV.	Decline of excitability	. . . 3 years

The number of historical events in each cycle are distributed approximately according to the data for 500 years (XV–XX Centuries) in the following manner (on the average):

I period	. . . 5%	III period	. . . 60%
II period	. . . 20%	IV period	. . . 15%

4. The course and development of each lengthy historical event is subject to fluctuations (periods of activity and inactivity) in direct dependence upon the periodical fluctuations occurring in the sun's activity. Formula: the state of predisposition of collective bodies towards action is a function of the sunspot periodical activity.

5. Episodical leaps or rises in the sun's activity, given the existence in human societies of polito-economical and

other exciting factors, are capable of calling forth a synchronic rising in human collective bodies. Formula: the rising of the sunspot activity transforms the people's potential energy into kinetic energy. Professor Tchijevsky's studies in the sphere of synthesizing historical material have enabled him to determine the following morphological law of the historical process.

6. The course of the universal historical process is composed of an uninterrupted sequence of cycles, occupying a period equaling in the average, eleven years and synchronizing in the degree of its military-political activity with the sunspot activity. Each cycle possesses the following historiopsychological characteristics:

(a) In the middle points of the cycle, the mass activity of all humanity, assuming the presence in human societies of economical, political or military exciting factors, reaches the maximum tension, manifesting itself in psychomotoric pandemics; revolutions, insurrections, expeditions, migrations, etc. - thus creating new formations in the existing separate states and new historical epochs in the life of humanity. It is accompanied by an integration of the masses, full expression of their activity and a majority government.

(b) In the extreme points of the cycle's course, the tension of the all human military-political activity falls to the minimum, giving way to creative activity, and is accompanied by a general decrease of military or political enthusiasm, by peace and peaceful creative work in the sphere of state organizations, international relations, science and art, with a pronounced tendency toward absolutism in the governing powers and a disintegration of the masses.

7. The maximum of human activities in correlation with the maximum of sunspot activity, expresses itself in the following:

(a) The dissemination of different doctrines (political, religious, etc.), the spreading of heresies, religious riots, pilgrimages, etc.

(b) The appearance of social, military and religious leaders, reformers, etc.

(c) The formation of political, military, religious and commercial corporations, associations, unions, leagues, sects, companies, etc.

8. It is impossible to overlook the fact that pathological epidemics also coincide very frequently with the sunspot maximum periods.

9. Thus the existence of a dependence of the behavior of humanity on sunspot activity should be considered established.

One cycle of the all-human activity is taken by the author for the first measuring unit of the historical process. The science concerned with investigating the historical phenomena from the above point of view, Professor Tchijevsky has named "Historiometry," in other words, the measuring of historical times (epochs) by means of physical units. The cycle taken as a unit called by him, "historiometric cycle."

Professor Tchijevsky summarizes his statistical researches in a table which he calls, "Historiometrical table for the period from the Fifth Century B.C. to the Twentieth Century A.D.

The author also gives two diagrams illustrating this table.

He determined from the trend of the universal history nine historiometric cycles in every century, which are numbered in the Table from 1 to 9. This is the first experiment in compilation of such a table and of course the table is open to considerable correction in the future.

This Table gives only the size of the concentrations of the newly arising historical events and the sizes of comparative lulls between these events. He gives the following explanation of the Table:

Beginning with the V Century B.C. to the A.D. XVI, the centuries are divided into nine equal periods of eleven years each. The years of the beginnings of every period are shown in brackets.

From the II Century A.D. to the XVI Century, inclusive, the sunspot activity is taken from historical sources; heavy figures show the probable dates of sunspot maxima; heavy dots show the more reliable ones.

From the XVII Century to the XX, the dates of maxima and minima sunspots are taken from astronomical telescopic observations (Meteorologischen Zeitschrift, Heft 10, s. 327–1922).

The diagrams show average curves of the fluctuations of the universal historical process of the entire earth during the period from V B.C. to A.D. XX.

The second diagram shows on a larger scale the parallelism of the curves of sunspot activity (lower curve) and of the universal human military-political activity (upper curve) from 1749 to 1922.

The abscissae of both diagrams correspond to years, and the ordinates to the number of important historical events and sunspots. Heavy dots mark the dates of sunspot maxi- and recorded from the first pretelescopic observations and, later, from 1810, were taken from the results of telescopic astronomical observations. Hyphens mark the minima.

The curves on both diagrams are only the average and give a general conception, to be amended in the future to eliminate possible errors.

The fact that both curves on the second diagram are strictly parallel after the telescopic observations have been introduced and thus reliable astronomical data obtained for sunspot activity, only emphasizes the correctness of the whole theory.

III SOCIAL-PSYCHOLOGICAL CHARACTERISTIC OF A FULL CYCLE

The division of every cycle into four periods was the result of the study of the sequence of historical events in comparison with the trend of sunspot activity.

Entirely different events of universal history were analyzed, beginning with ancient Greek and Roman riots, insurrections and expeditions, and ending with revolutions and wars of recent years.

The formal resemblance in the development of different historical events, sometimes having nothing in common with each other neither in space nor in historical time but distinctly similar in their development, is the motive cause for assuming the existence of a definite periodical factor which stands outside of the influence of local, transitory and geographical conditions and which endows the course of quite different and various historical events with the same obligatory and almost universal inner law of sequence and morphologic identity. The outstanding feature of this law is that it is not absolutely stable, it varies only to a certain degree.

After synthesizing all the collected material, Professor Tchijevsky obtained for every period of his historiometric cycle the following characteristics, which are the generalized ideal conditions separated from various casualties or local and temporary influences.

THE FIRST PERIOD
(Period of the minimum of excitability)

The characteristics of this period are:

Lack of unity in human masses.
Indifference of the masses to political and military questions.
Peacefulness of the masses.
Tolerance and forebearance of the masses.

The results of these characteristics are:

Lack of any desire to struggle for the right or idea, easy capitulation, desertion, etc.

Historical facts illustrating this period, are peace treaties, capitulations, occupations, decrease or parlimentarianism, strength of autocracies, and the ruling of minorities.

THE SECOND PERIOD
(Growth of excitability)

This period is very complicated psychologically and historically and thus the researches made by the author were very extensive and the material collected very abundant. Therefore, only schematical extracts will be mentioned.

The characteristics of this period are:

Beginning of uniting of masses; new leaders appear, political, military, orators; new programs are worked out; increasing work and influence of the press; political and military questions arise and begin to predominate the masses.

The end of this period can prove stormy, producing impatient and nervous masses. The length of this period varies greatly, depending upon the length and range of sunspot activity and the numerous local factors and conditions which give different forms to the development of the whole period.

One of the most important properties of the military-political life of human societies in this period is the tendency of different nations to unite for common defense or aggression and the fusion of different political groups to oppose other groups.

Three principal phases of this period are: (1) The originating of new ideas in the masses; (2) the grouping of these ideas; (3) The crystallization of one predominent idea with concentration of numerous separate groups around one psychic center and on one unique idea.

These three phases of the second period sometimes develop themselves entirely mechanically with no individual participation of separate personalities and this prepares unexpected effects of unity in the masses in the forthcoming third period, the period of maximum excitability.

Thus arises the necessity of an urgent solution of a sole predominant question which holds the masses and which agitates them.

THE THIRD PERIOD
(Period of maximum excitability)

This is the principal period of every cycle, which gives solution to the greatest problems of humanity. This period inspires nations to the greatest insanities, as well as to the greatest achievements.

The most prominent events of the universal human history occur in this period: such as, the greatest revolutions and wars which bring new eras into man's history, thus confirming the formula of Heraclites, "Polemos panton esti pater kai basileus" - "The war is the father and king of all."

Professor Tchijevsky, in his original work which is called, "The Foundation of Historiometry," gives a detailed analysis of the abundant material pertaining to this period, which he has collected; while in his present work, he only enumerates the principal factors, as follows: (1) The provoking

influence of leaders upon the masses; (2) The exciting effect of emphasized ideas upon the masses; (3) The velocity of incitability due to the presence of a single psychic center; (4) The extension area covered by the mass movements; (5) Integration and individualization of masses.

Unlike the pervious periods when nothing could excite the masses, the influence of a Leader has such a gripping effect during the third period that a single word or gesture from him at the important moment can raise the enthusiasm of the masses and move armies into action.

Professor Tchijevsky demonstrates that at the heat of these mass movements in history, stand the greatest military and political geniuses and spiritual leaders, and founders of nations and countries.

This period can be justly called the period of advent of the people and the expression of their voices.

Historians sometimes are at a loss to explain why ideas which may be freely and unhestiatingly discussed at this period, were considered unmentionable only one to three years previously.

The masses become more impatient, nervous and exacting. Riots, bloody conflicts, insurrections among the masses, are followed by the overthrow of all obstacles; the opposing elements are mercilessly destroyed, offering only feeble resistance as if being in a state of coma.

The masses are on their way to anarchy. In one word, the state of humanity is such as to demand an eruption. This state can be explained by an acute change in the nervous and psychic tonus of the masses. In these great tensions of humanity the sense of fear and self-defense may temporarily be atrophied or suppressed in individuals and in masses.

Thus the foundation is being prepared for the solutions of the greatest problems and questions of universal historical character; the foundation from which arises systems of human societies. Here take place events of a scale scarcely possible in other periods of the historiometric cycle.

Professor Tchijevsky states the fact that the greatest revolutions, wars and other mass movements which have created nations and whole systems of states; have given origin to the turning points of history; and have shaken the life of humanity on entire continents, tend to coincide with the periods of the maxima of the sun's activity, and to attain their maxima in the moments of the highest points of this activity.

The study of historical events in the third period allows the author to state the following facts pertaining to this period: The uniting of masses; appearance of leaders, military, political and social; triumph of ideas upheld by the masses; the maximum of parlimentary practices; democratic and social reforms; limiting of autocracies; insurrections, rebellions, mutinies, revolutions, wars, campaigns, expeditions, emigrations, migrations, persecutions, etc. For illustration, a few of the numerous facts which have been studied by Professor Tchijevsky are cited below:

(1) Turning points of the universal History

1491 - The fall of the Mahometan yoke in Spain.
Discovery of America
Beginning of modern history.
1789 - French Revolution
1917 - Russian Revolution

(2) Insurrections and Revolutions

1306 - Insurrection in England
1358 - Insurrection in France
1368 - Insurrection in China
1381 - Insurrection in England
1525 - Insurrection in Germany
1648 - Revolution in England
1789 - Revolution in France
1830 - Revolution of July
1848 - Revolution of February and All-European Crisis
1870 - Commune of Paris
1905 - Revolution in Russia
1917 - Revolution in Russia

(3) Crusades

1094-1096 -	First	1203-1204 -	Fourth
1147-	Second	1224-	Fifth
1187-	Third	1270-	Seventh

(4) Migrations of Nations

374, 409, 449 - 451 - 452, 568

(5) Persecutions of Christians

303, 362, 575, etc.

(6) Sanguinary events of universal history

1204 - Downfall of Byzantium
1572 - The Night of St. Bartholomew in France
1588 - Executions in London
1792 - Terror in France, etc.

(7) The rising of national leaders

395 - Allarick	1648 - Oliver Cromwell
441 - Attila	1777 - Lafayette
622 - Mohamet	1777 - Washington
1096 - Peter of Amiens	1805 - Wellington
1402 & 1412 - John Guss	1848 & 1860 - Garibaldi, Bismarck
1429 - Joan of Arc	
1489 - Savonarolla	1870 - Moltke
1519 - 1525 - Luther, Zvingly	1870 - Gambetta, Thiers
1537 - Ig. Loyola	1917 - Lenin
1625 - Richelieu	Etc.

(8) Periods between the Greatest Battles During the During the Five Centuries B.C.

V Century - 490-480, 466-433, 433-425, 425-415, 415-405
IV Century - 390-371, 371-362, 362-340, 340-331, 331-301
III Century - 280-272, 272-260, 260, 241, 241-222, 222-212, 212-202
II Century - 197-190, 190-168, 168-102
I Century - 86-74, 74-66, 66-46, 46-30

(9) The duration of lengthy events is generally the multiple of ten or eleven years

375- 476 (101 years) - Great migrations of peoples.
622- 632 (10 years) - Activity of Mohamet
1389-1448 (59 years) - Wars: Christians & Turks
1460-1741 (11 years) - War between White and Red Rose
1489-1498 (9 years) - Activity of Savonarolla
1789-1804 The beginning and final points of the great French Revolution.
1848-1860 Insurrection of Garibaldi
And many other examples.

(10) Epidemic diseases

1370 - Cholera in Persia. (Hiragama mentions Chinese historians who tell of large sunspots at this time, which were seen with the naked eye.)
In the XIX Century -

Sunspots		Cholera Epidemics		
Maxima	Minima	Beginning	Maxima	Ending
1816	1823	1816	1817	1823
1829/37	1833	1827	1829-31 - 1837	1833
1848	1856	1844	1848	1847
1860	1867	1863	1863-66	1875
1870	1878		1870-72	
1883	1889	1883	1883-86	1889
1894	1900	1890	1892-894	

THE FOURTH PERIOD
(Period of decreasing excitability)

From the historical-psychological point of view, this period is of no less interest than the preceding one; it can also contain many important events which having been originated in general in the previous period, now complete themselves. Mass movements show their last convulsions as if before death. The masses become more and more inert and apathetic with a clearly proven tendency for peace. Lack of unity in the masses gives rise to disputes in collectives, unions and nations.

The physical exhaustion and fatigue of the masses produces a new psycho-physical state which may be called enervation.

These general properties of each period of the historiometric cycle show, according to Professor Tchijevsky, a morthological identity of all historical cycles; i.e., the same universal sequence of the behavior of active human masses in every cycle.

Undoubtedly, the actual historical events are much more complicated than they are schematically presented here; but mainly due to this schematization and simplification which are to be considered, according to Professor Tchijevsky, as preliminary, we are able to proceed in the objective study of this question.

The changes in the mode of behavior of the masses are especially conspicuous in the development of prolonged historical events.

The number of historical events, and more so, the intensity of their development has a tendency to follow in the detail the changes of the curve of sunspot activity; but it occurs sometimes that the maxima of human activities are attained shortly before the sunspot maxima, or they somewhat lag behind these maxima.

IV THE INFLUENCE OF GEO-PHYSICAL AND COSMIC FACTORS ON THE BEHAVIOR OF COLLECTIVES AND INDIVIDUALS

It was also necessary to give an explanation of the regular sequences in the universal human activities from the standpoint of contemporary bio-physics. But first, the question should be solved: Is the influence of the sun's activity upon the centers of man's nervous system direct or indirect; i.e., through such factors (for example) as famine following a drought as a result of the sun's activity.

The researches made proved that such factors often coincide with the development of the cycle, but never can

be called predominant or indispensable to its development. (*) This is obvious from the fact that every century had the same number of concentrations of historical events and that the events took place simultaneously in different parts of the world.

If the development of historical events were left by itself, no definite period in its regular fluctuations nor simultaneous advent of it over the entire world, could ever be observed.

Therefore, we must assume that there exists a powerful factor outside our globe, which governs the development of events in human societies and synchronizes them with the sun's activity; and thus, we must also assume that the electrical energy of the sun is the super-terrestrial factor which influences historical processes.

The potential of the atmospheric electricity is always changing under different factors of the earth; temperature, humidity of atmosphere, amount of sunlight received, radiation of the earth itself, etc., all of which depend upon the amount of emitted sun energy.

These fluctuations are felt by human nervous systems, especially if they are sensitive.

Often these fluctuations pass unnoticed by calloused and strong natures, but even these natures re-act to the more pronounced fluctuations, causing in them a state of nervous tonus sometimes called, "change of humor" with no evident cause.

Professor Tchijevsky further refers to many authors and cites a great number of opinions, in confirmation of the aforesaid. Some of the names are given below: Herbert Spencer (1820–1903); the Russian Physiologist Professor Pavloff; the Russian Meteorologist Professor Klossovsky (in his "Physical Life of Our Planet according toContemporary Science"); Arrhenius (in "The Influence of Cosmic Factors on the Physiologic Functions"); Fits-Roy, Orloff, Dr. Dexter, Leman, Pedersen, Lombroso.

The English Psychiatrist Maudsley says, "We vibrate in tune with individual influences of the sky and earth, which cannot be measured by contemporary science." The French Astronomer Nordmann considers that even the smallest fluctuations of the outer world of matter must exert their influence upon the general condition of man's nervous system and produce changes in his psychic activities. Nordmann sees, in the laboratory electroscope, one of the most powerful forces of the future state, the regulator of the social regime, of the prosperity of the country and the behavior of the citizens.

And not only human beings respond to the fluctuations of the surrounding matter, but even animals and plants (French Entomologist Fabre).

The nervous activity is being studied at present in some laboratories with the help of physical and chemical methods. The works of great American and European scientists such as J. Loeb, W. Nernst, P. Lazareff-Director of the Institute of Biology in Moscow, show that the basis of nervous activity lies in the physical-chemical process.

The same is found in the process of thought, as stated in Biophysics and Ionic theories by Lazareff.

NOTE: Owing to lack of space, only those few names and sources are cited from the many enumerations given by Professor Tchijevsky.

During the last War, the author made very interesting observations: the appearance of large sunspots was immediately followed by increased activities on different battle fronts simultaneously. The first observation was made in the middle of June 1915 when a large group of sunspots crossed the central meridian of the sun, and when the aurora borealis were exceedingly powerful in North American and Northern Europe, and magnetic storms were exceptionally strong and interfered with telegraph work. At the time of these phenomena, the hardest and bloodiest fights of the war were being fought by Germans, Russians, Austrians, Serbians, French and English.

These observations were the author's first impulse to begin his present research work.

The Russian Revolution of February and October 1917, and the Revolutions in Germany and Austria also followed an exceptionally powerful rising of sunspots.

There are indications that at the time of the maximum of the number of sunspots, the number of psychomotoric excesses greatly increases. For the purpose of finding out this dependence, the author made a special research which showed that the dates of the greatest agitations in the masses coincided in time with the dates of great perturbations in the matter of the sun.

These coincidences, surprising in their significance, give such an amount of probability to the whole theory, that the author thinks they justify his assiduous and painstaking study of the subject;

Concluding this chapter, Professor Tchijevsky says that historical events develop by a certain series of jolts which are the results of fluctuations in the sunspot development process.

He also says that the study of social events in correlation with geophysical and cosmic events must result in illucidating the general law which governs mass activities of men and to make possible a scientific foundation for the study of laws of human societies.

*C. Lombroso & R. Laschi "Le Crime Politique." pp. 113, 122, etc.

V PROSPECTS AND CONCLUSIONS

The changes in the lives of individuals also depend upon the changes in the periodical activity of the sun; as an example, Professor Tchijevsky mentions the life of Napoleon. The maxima and minima of Napoleon's activities correspond to the same periods in the sunspot activity. Thus, 1809–1811, minimum of sunspot activity (Wolf) and no campaigns; 1804 maximum of sunspots and the greatest campaigns of Napoleon with the title of emperor; 1816 again sunspot maximum and a new period of war which brought Napoleon to St. Helena.

In making his conclusions, Professor Tchijevsky states that his researches were merely the first efforts in this direction and that only the united efforts of men of science, in the development of the theory of correlation between the sun's activity and human activities, can give a stable foundation to this new branch of science which he believes will have such an important bearing on the future of humanity.

As a result of his theories, Professor Tchijevsky forecasts for the years 1927–1929, when the 11-year period of sunspot activity attains its maximum and when this maximum will coincide with the maxima of two other period of sixty years (Young) and thirty-five years (Bruckner, Lockyer), a great human activity of the highest historical importance which may again change the political chart of the world as was the result of a similar maximum in 1870.

The theory developed by the author, relating to the dependence of behavior of the masses upon the cosmic influence, is the deduction from the main principles of contemporary biophysics and can serve in a certain way as a confirmation of these principles.

Biophysics makes an assumption that the entire organism of man must be under the effect of powerful cosmic and geophysical factors.

The different events of the universal human history, in the light of the theory of Professor Tchijevsky, assume a new inner meaning and importance: they do not take place arbitrarily but are subordinate to physical laws of the physical world surrounding us. They can originate only when all the complicated politico-economic and other factors in humanity, with the physical factors of the world of inorganic nature, will favor them.

Due to the time development of historical events under control of certain physical laws, any fact in the life of separate human societies or in international life of humanity can be explained, and this will bring History to the level of the exact sciences ruled by definite laws. Professor Tchijevsky foresees that, in the near future, History and Sociology will have a system of measuring units.

Step by step, the exact sciences begin to penetrate the chaos of history, to measure it with identical time units and explain events which took place in remote times. Thus History is being changed into a science of the living, the necessary and the near; this new aspect revives events which seemed long dead, and gives clear explanation to them as well as to historical personalities and their doings.

The elemental changes of the processes in the sun are followed by a certain change in material processes in the organs of man's higher nervous activity, and these processes violate the general line of behavior of humanity, which the author calls, "the historical process."

Then arises the question: are we not in the slavery of the sun and its electrical power? The answer is, Yes, in a certain way we are, but this yoke is only comparative, as we can direct our activities in the right way. The sun does not oblige us to do this or that; it only obliges us to do *something*. But humanity follows the way of least resistance and drowns itself in oceans of its own blood.

As has already been shown by the author, the maximum of sunspot activity favors the excitability and uniting of the masses for attaining a certain general necessity brought forward by economic or other causes, and bring forth mass actions and leaders. But these acts are not inevitable; all depends upon previous events. For example; if a war is already in progress from the previous period, the general excitement may assume the form of ardor for peace at any price. The essential point of the third period (maximum) is the mass determination for attaining a sole result.

History knows many good examples of mass excitements in the period of maximum which had nothing in common with the sanguinary events; such as, some religious movements; pilgrimages; growing democracy; localization of public attention to legal processes, reforms, engineering projects; etc.

This gives origin to an idealistic hope that the culture of future generations will find ways to a humanitarian use of the mass upheaval, by means of preliminary propaganda for some undertaking of great public interest and importance which is to be completed in the period of the maximum of excitability. Then scientific expeditions, sport competitions, building of stupendous structures (bridges, canals, railroads, whole towns, etc.), collective theatrical art, collective creative art with mass participation, would occupy the place of human bloody slaughter.

Таб. 1. Опыт построения историометрической таблицы (всех народов с V в. до Р. Хр. по XX в.).

	V век. до Р. Хр. (В. С.).		IV.		III.	
№ №	Равные 12-летние периоды.	Историометрические циклы.	Равные 11-летние периоды.	Историометрические циклы.	Равные 11-летние периоды.	Историометрические циклы.
	(500)					
1	(489)	494—487	(389)	396—390	(289)	286—278
2	(478)	480—479	(378)	382—376	(278)	275—271
3	(467)	470—460	(367)	371—362	(267)	266—260
4	(456)	457—453	(356)	355—351	(256)	256—249
5	(445)	450—447	(345)	344—338	(245)	243—237
6	(434)	435—431	(334)	335—326	(234)	230—227
7	(423)	428—422	(323)	323—321	(223)	225—215
8	(412)	418—410	(312)	311—307	(212)	212—206
9	(401)	407—399	(301)	301—295	(201)	202—195

	II.		III.		IV.	
№ №	Равные 11 летние периоды.	Историометрические циклы.	Равные 11-летние периоды.	Историометрические циклы.	Дейт. солнца по ист. данным.	Историометрические циклы.
1	(101)	101—106	(201)	197—201	301 ●	303
2	(112)	114—116	(212)	209—216	311	311—314
3	(123)		(223)	221—226	322	323
4	(134)	132	(234)	231—234	342	340
5	(145)	147	(245)	242	354 ●	351
6	(156)	162—167	(256)	248—251	359	357—363
7	(167)	173	(267)	260—269	374 ●	371—378
8	(178)	178	(278)	272—277(285)	388	383—391
9	188	181	(289)	295—296	395	394—397

	VIII.		IX.		X.	
№ №	Дейт. солнца по ист. данным	Историометрические циклы.	Дейт. солнца по ист. данным.	Историометрические циклы.	Дейт. солнца по ист. данным.	Историометрические циклы.
1	(704)		(797)	798—802	(896)	899—904
2	(712)	711—712	807	808—812	905	907—915
3	(723)	717—720	(818)	823—824	919—930 (?)	921—929
4	(731)	732—733	830	832—833	940	937—941
5	745	737—740	840 ●	841—846	(948)	944—947
6	(755)	752—759	848 (?)	856—859	956	961—955
7	765	—	860	865	(966)	961—969
8	778	772—782	874	875—878	974	973—978
9	786	787—793	(885)	886—891	979—993 (?)	981—988

	XIV.		XV.		XVI.	
№ №	Дейт. солнца по ист. данным	Историометрические циклы.	Дейт. солнца по ист. данным.	Историометрические циклы.	Дейт. солнца по ист. данным.	Историометрические циклы.
1	1307	1303—1307	1402	1398—1403	(1500)	1499—1502
2	(1312)	1311—1315	(1403)	1408—1415	(1510)	1509—1512
3	1325	1322—1330	(1424)	1419—1422	1520 1527	1517—1528
4	(1336)	1337—1340	1431	1427—1434	1537	1531—1536;1542
5	1353 ?	1345—1353	1446	1443—1456	1551 ●	1549—1553
6	1365	1356—1365	1461	1458—1464	1560 ●	1558—1563
7	1372 ●	1368—1372	(1472)	1469—1471	1572 ●	1566—1573
8	1383	1377—1385	(1483)	1476—1486	1581 ●	1578—1582
9	(1394)	1388—1396	1490	1489—1495	1588 ●	1585—1592

Table 1: REPRODUCTION OF TCHIJEVSKY'S TABLE.

COLUMN HEADINGS FOR EACH CENTURY READ AS FOLLOWS: FIRST COLUMN, V CENTURY B.C. THROUGH III CENTURY A.D. "EQUAL 11-YEAR PERIODS." FIRST COLUMN, IV CENTURY A.D. THROUGH XVI CENTURY A.D. "SUN'S ACTIVITY FROM HISTORIC DATA." FIRST COLUMN, XVII, XVIII, AND XIX CENTURIES, "SUN'S ACTIVITY, MAXIMUM AND MINIMUM."

Historiometrical table during the period from V B. C. till XX A. D. Experiment of its construction.

II.		I.		I век. по Р. Хр. (A. D.).	
Равные 11-летние периоды.	Историометрические циклы.	Равные 11-летние периоды.	Историометрические циклы.	Равные 11-летние периоды.	Историометрические циклы.
(189)	191—189	(89)	90—82	(1)	6—9
(178)	186—183	(78)	78—72	(12)	14—19
(167)	171—165	(67)	69—62	(23)	
(156)	156	(56)	58—51	(34)	
(145)	149—143	(45)	49—41	(45)	42—45
(134)	135—133	(34)	33—31	(56)	58—59
(123)	126—118	(23)	27—25	(67)	64—70
(112)	113—108	(12)	16—12	(78)	78—85
(101)	105—101	(1)		(89)	91
V.		VI.		VII.	
Деят. солнца по ист. данным.	Историометрические циклы.	Деят. солнца по ист. данным.	Историометрические циклы.	Деят. солнца по ист. данным.	Историометрические циклы.
401	401—406	502	507—510	603	602—604
(412)	408—415	(513)	515—517	(614)	614—618
(423)	419—420	535	529—536	626	622—628
(434)	428—433	(546)	539—543	(634)	633 637
450 ●	448—455	(557)	551—555	(645)	641—642
(467)	465	566 ●	566—568	(656)	653
(478)	476	577 ●	575	(667)	668—670
(489)	486—493	585 ●	581	(678)	681—687
(500)	496	(596)	-	(689)	695—697
XI		XII.		XIII.	
Деят. солнца по ист. данным	Историометрические циклы.	Деят. солнца по ист. данным.	Историометрические циклы.	Деят. солнца по ист. данным.	Историометрические циклы.
1005	1000—1004	1104 ●	1103—1106	1202 ●	1201—1205
1014	1012—1015	1118 ●	1113—1119	(1213)	1211—1216
(1025)	1026 1030	1129 ●	1124—1132	(1221)	1223—1228
1039	1035—1041	1137 ●	1135—1139	1238—1242	1234—1236
(1050)	1044—1052	1145	1143—1147		1239—1246
(1061)	1056—1059	1157	1151—1162	(1253)	1255—1256
(1072)	1068—1073	(1168)	1166—1176	1269	1265 1270
1078 ●	1075—1085	1185 ●	1182—1188	1276	1275—1282
1096	1093—1100	1193	1191—1197	1292	1285—1293
XVII		XVIII.		XIX.	
Деят. солнца. Max. Min.	Историометрические циклы.	Деят. солнца Max Min.	Историометрические циклы.	Деят. солнца. Max. Min.	Историометрические циклы.
1605 ● 1610.8	1596—1607	1705.5 1712.0	1709—1711	1805.2 1810.6	1797—1809
1615.5 1619.0	1612—1618	1718.2 1723.5	1714—1722	1816.4 1823.3	1812—1822
1626.0 1634.0	1624—1632	1727.5 1734.0	1728—1734	1829.9 1833.9	1824—1833
1639.5 1645.0	1635—1643	1738.7 1745.0	1737—	1837.2 1843.5	1835—1843
1649.0 1655.0	1647—1657	1750.3 1755.2	—1750	1848.1 1856.0	1845—1856
1660.0 1666.0	1658—1664	1761.5 1766.5	1756—1764	1860.1 1867.2	1857—1868
1675.0 1679.0	1666—1677	1769.7 1775.6	1768—1775	1870.6 1878.9	1870—1877
1685.0 1689.5	1682—1689	1778.4 1784.7	1778—1781	1883.9 1889.6	1879—1888
1693.0 1698.0	1690—1698	1788.1 1798.3	1787—1794	1894.1 1901.7	1891—1900

SECOND COLUMN THROUGHOUT THE TABLE READS, "HISTORIOMETRICAL CYCLE."

HEAVY FIGURES SHOW THE PROBABLE DATES OF SUNSPOT MAXIMA: HEAVY DOTS SHOW THE MORE RELIABLE ONES (AS KNOWN IN 1924). FROM THE XVII CENTURY TO THE XIX CENTURY THE DATES OF SUNSPOT MAXIMA AND SUNSPOT MINIMA ARE TAKEN FROM ASTRONOMICAL AND TELESCOPIC OBSERVATIONS. Ed.

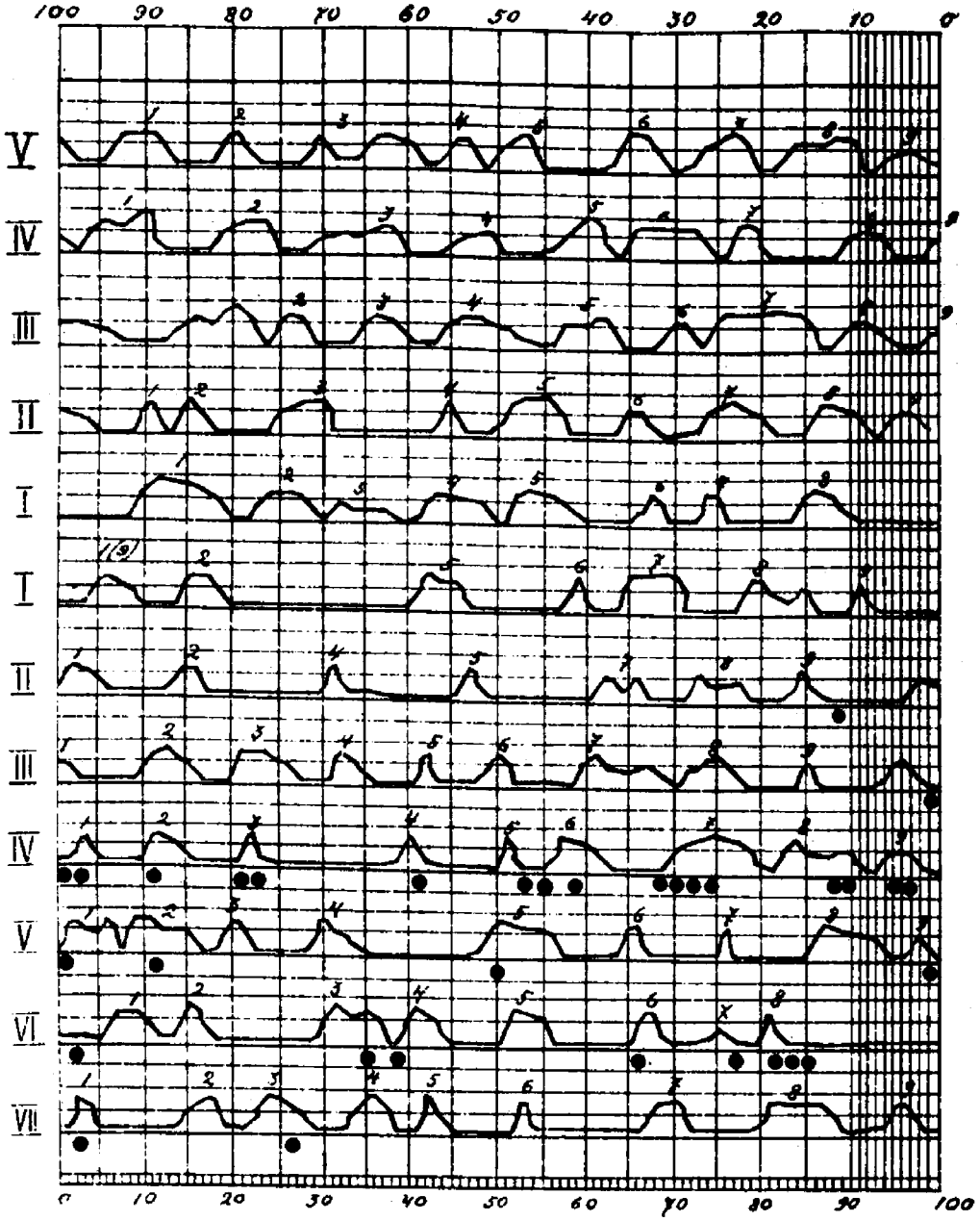
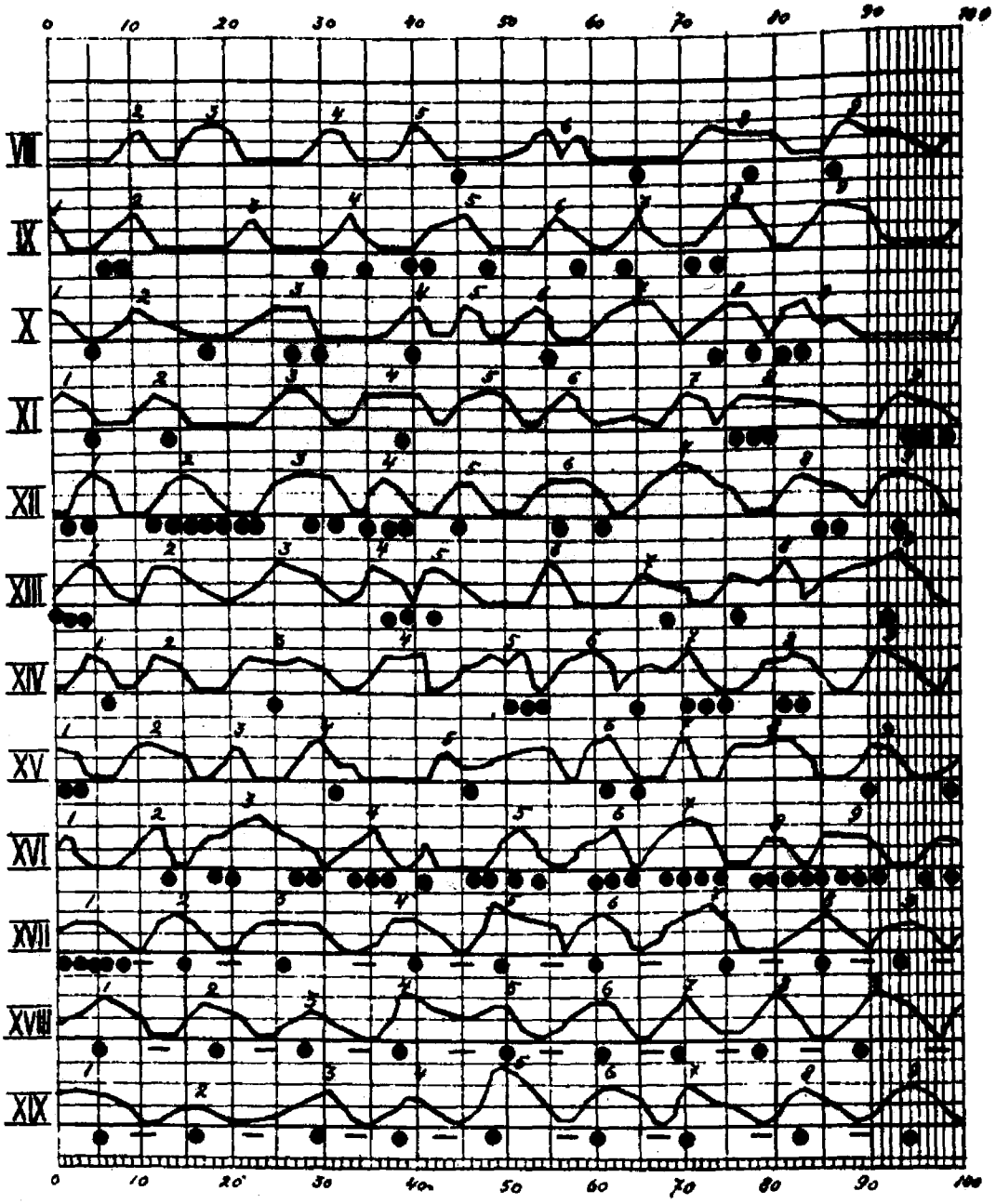


Fig. 2 and Fig. 3: THE FLUCTUATIONS' MEAN CURVES OF THE UNIVERSAL HISTORICAL PROCESS ON ALL THE SURFACE OF THE EARTH DURING THE PERIOD FROM V CENTURY B.C. TILL XX CENTURY A.D. ALONG THE AXIS ABSCISSAE ARE MARKED THE YEARS. ALONG THE AXIS ORDINATES–THE QUANTITY OF IMPORTANT HISTORICAL EVENTS. DOTS MARK THE PRETELESCOPIC AND LATER–ASTRONOMICAL DATA OF THE SUNSPOT MAXIMUM. HYPHENS MARK ITS MINIMUM.


0 10 20 30 40 50 60 70 80 90 100
VII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII
XVIII
XIX
0 10 20 30 40 50 60 70 80 90 100

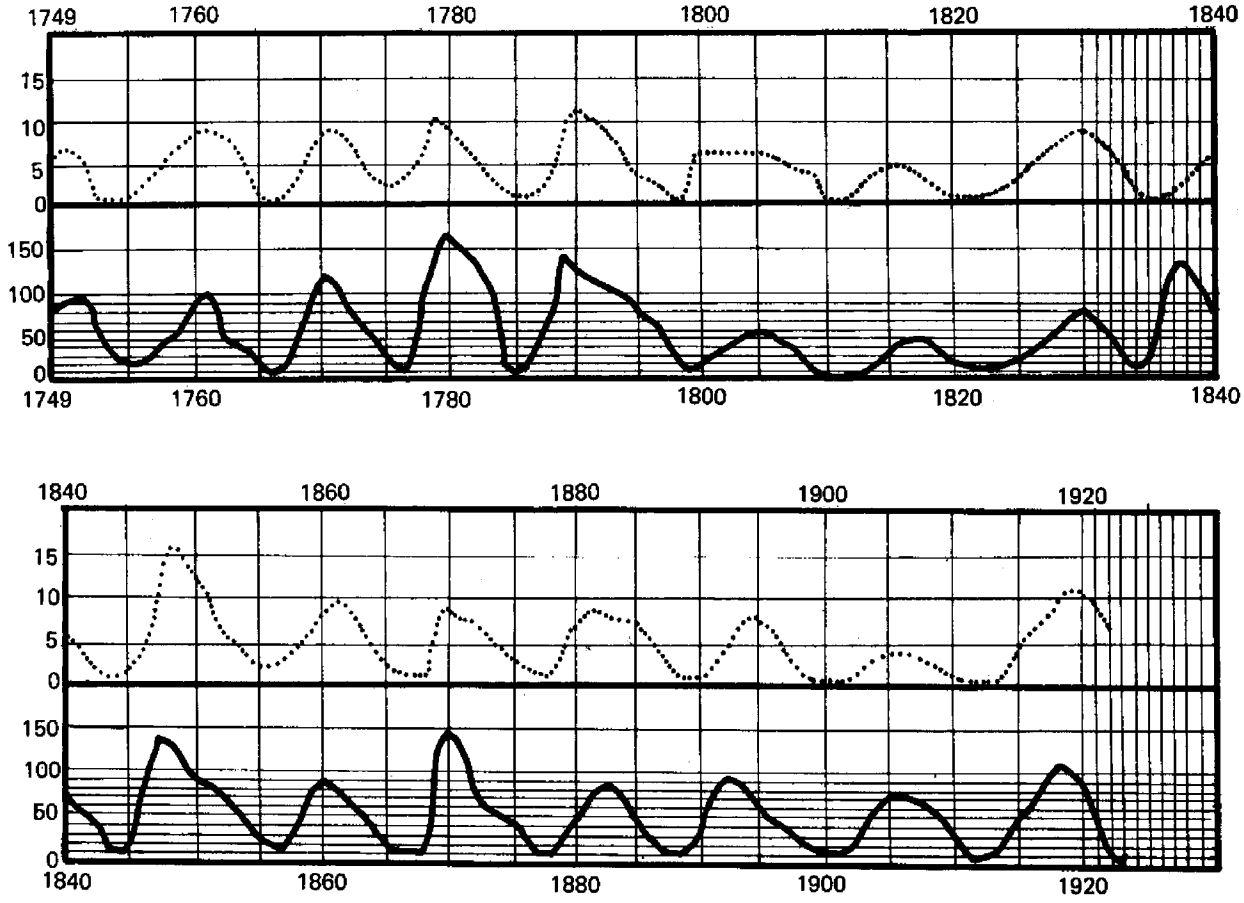


Fig. 4: PARALLELISM OF THE CURVES OF SUNSPOT ACTIVITY (BELOW) AND THE UNIVERSAL HUMAN MILITARY. POLITICAL ACTIVITY (ABOVE) FROM 1749 TILL 1922.

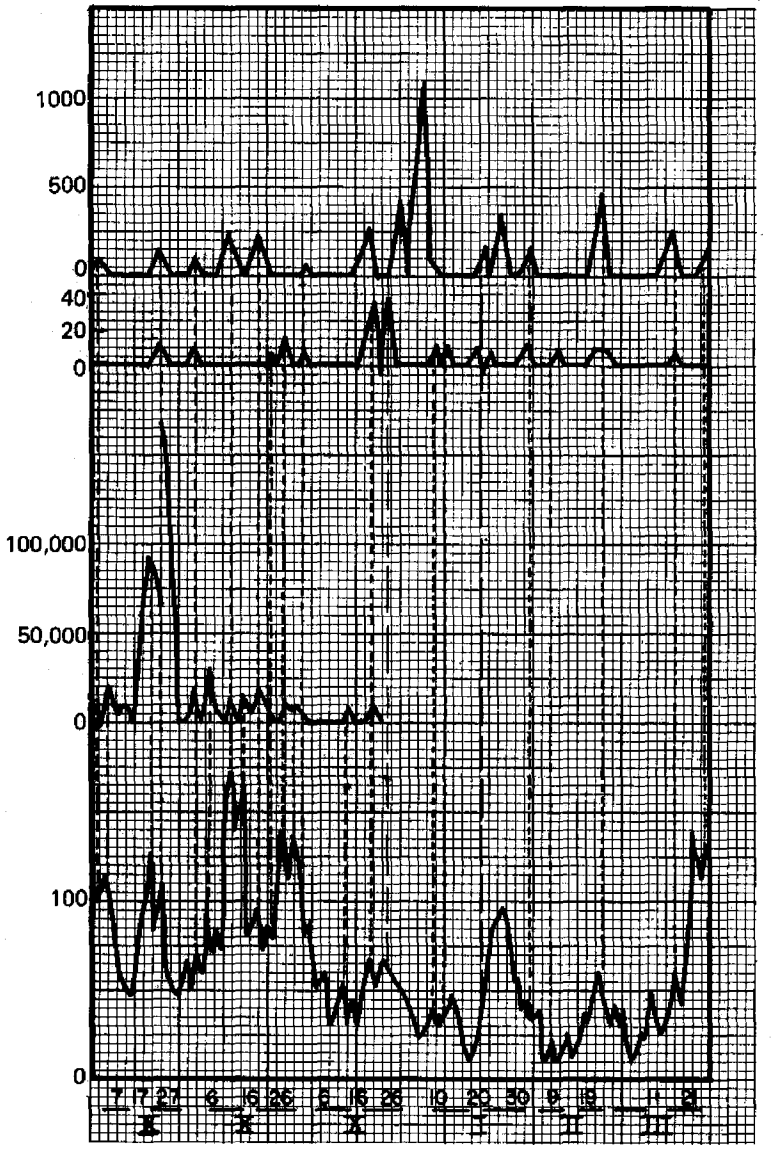


Fig. 5: COINCIDENCE OF THE EPISODIC LEAPS IN THE SUNSPOT ACTIVITY (LOWER CURVE) AND THE OUTBURSTS OF REVOLUTIONARY ACTIVITY IN THE MASSES ON THE TERRITORY OF RUSSIA DURING THE PERIOD FROM 1 OCTOBER 1905 UNTIL 1 APRIL 1906 (STRIKES AND MEETINGS: BOMBS AND ATTEMPTS: IMMEDIATE REPRESSION).

To the blessed memory of A.L. Tchijevsky

TCHIJEVSKY'S DISCLOSURE: HOW THE SOLAR CYCLES MODULATE THE HISTORY

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PHYSICAL FACTORS OF THE HISTORICAL PROCESS

Summary to the booklet:

Tchijevsky. Physical Factors of the Historical Process. A short sketch. Kaluga, 1924. – 72 p.

SUMMARY

The principles of modern natural science have urged me to investigate whether or not there existed a correlation between the more important phenomena of nature and events in the social-historical life of mankind. In this direction, beginning in the year 1915, I have performed a number of researches, but at present I am submitting to the public only those which are directed towards determining the connection between the periodical sun-spot activity and (1) the behavior of organized human masses and (2) the universal historical process.

The following facts are based upon statistics gathered by me while submitting to a minute scrutiny the history of all the peoples and states known to science, beginning with the V century B. C. and ending with the present day.

1. As soon as the sun-spot activity approaches its maximum, the number of important mass historical events, taken as a whole, increases, approaching its maximum during the sun-spot maximum and decreasing to its minimum during the epochs of the sun-spot minimum.

2. In each century the rise of the synchronic universal military and political activity on the whole of the Earth's territory is observed exactly 9 times. This circumstance enables us to reckon that a cycle of universal human activity embraces 11 years (in the arithmetical mean). (See. Fig. 2, 3 & 4, also historiometrical table, p. p. 30—31).

3. Each cycle according to its historical psychological signs is divided into 4 parts (periods):

I. Minimum of excitability .....3 years;
II. growth „ „ .....2 „
III. maximum „ „ .....3 „
IV. decline „ „ .....3 „

The number of historical events in each cycle are distributed approximately according to the data for 500 years (XV—XX cent.) in the following manner (in the mean):

I period 5%;
II „ 20%;
III „ 60%;
IV „ ….....15%;
(See diagram on p. 29).

4. The course and development of each lengthy historical event is subject to fluctuations (periods of activity and inactivity) in direct dependence upon the periodical fluctuations occurring in the sun's activity. Formula: the state of predisposition of collective bodies towards action is a function of the sun-spot peri-

odical activity.

5. Episodic leaps or rises in the sun's activity, given the existence in human societies of politico-economical and other exciting factors, are capable of calling forth a synchronic rising in human collective bodies. Formula: the rising of the sun-spot activity transforms the people's potential energy into kinetic energy. (See Fig. 5).

My studies in the sphere of synthesizing historical material have enabled me to determine the following morphological law of the historical process:

6. The course of the universal historical process is composed of an uninterrupted row of cycles, occupying a period equaling in the arithmetical mean 11 years and synchronizing in the degree of its military-political activity with the sun-spot activity. Each cycle possesses the following historio-psychological peculiarities:

a. In the middle points of the cycle's course the mass activity of humanity all over the surface of the Earth, given the presence in human societies of economical, political or military exciting factors, reaches the maximum tension, manifesting itself in psycomotoric pandemics: revolutions, insurrections, expeditions, migrations etc., creating new formations in the existence of separate states and new historical epochs in the life of humanity. It is accompanied by an integration of the masses, a full expression of their activity and a form of government consisting of a majority.

b. In the extreme points of the cycle's course the tension of the all-human military-political activity falls to the minimum, ceding the way to creative activity and is accompanied by a general decrease of military or political enthusiasm, by peace and peaceful creative work in the sphere of state organizations, international relations, science and art, with a pronounced tendency towards absolutism in the governing powers and a disintegration of the masses. (See p. 51).

7. In correlation with the sun-spot maximum stand:

a. The dissemination of different doctrines political, religious etc., the spreading of heresies, religious riots, pilgrimages etc.

b. The appearance of social, military and religious leaders, reformists etc.

c. The formation of political, military, religious and commercial corporations, associations, unions, leagues, sects, companies etc.

8. It is impossible to overlook the fact, that pathological epidemics also coincide very frequently with the sun-spot maximum periods (see table on p. 47).

9. Thus the existence of a dependence between the sun-spot activity and the behavior of humanity should be considered established.

One cycle of all-human activity is taken by me for the first measuring unit of the historical process. The science concerned with investigating the historical phenomena from the above point of view I have named historiometria.

At present I am working on a plan of organizing scientific institutes for determining the influence of cosmic and geophysical factors upon the condition of the psychics of individuals and collective bodies, and devising a working method for them.

A. Tchijevsky.
November, 1922.
10, Ivanovskaia, Kaluga, Russia.

5.2. PHYSICAL FACTORS OF THE HISTORICAL PROCESS

ILLUSTRATIONS

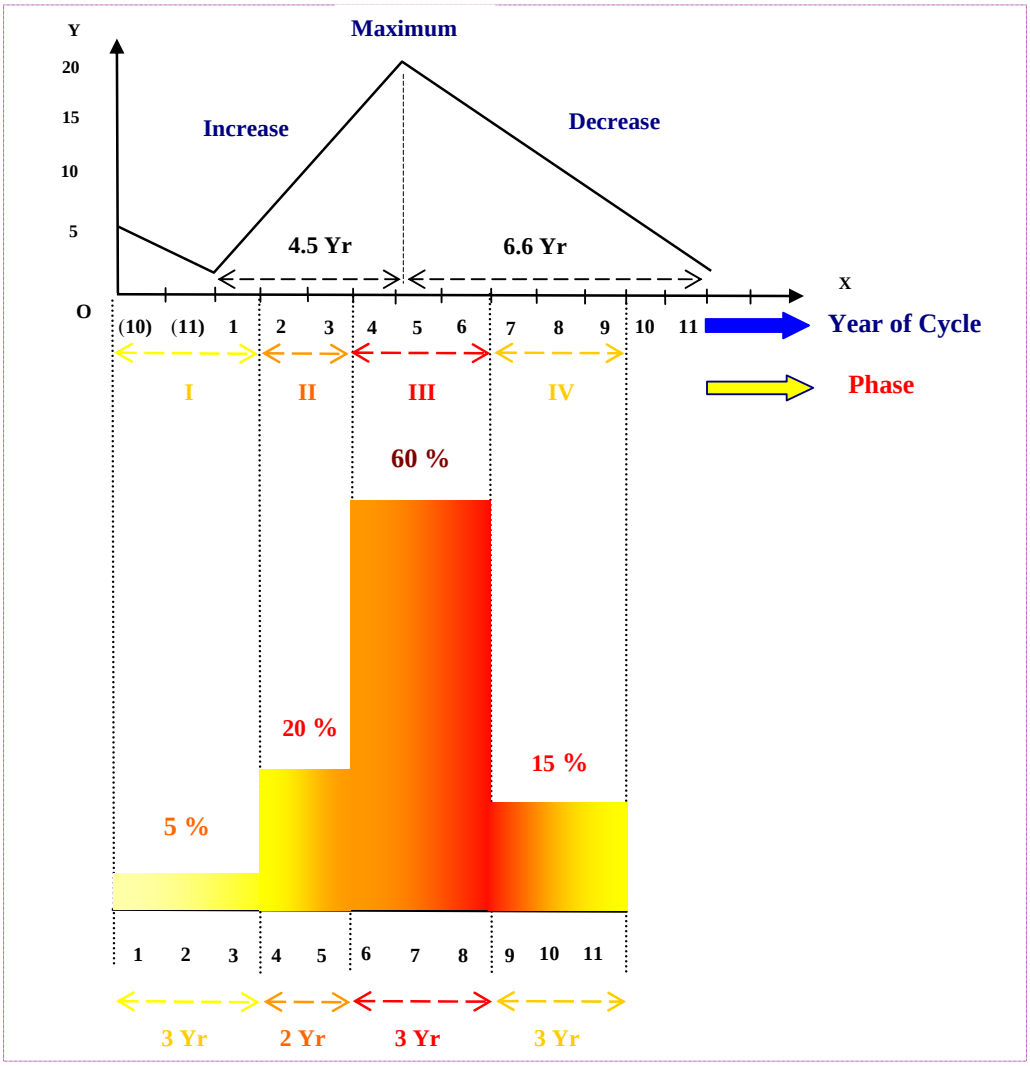

Fig.1. Percentage diagram for the number of originations of historical events, per Solar cycle years and phases, as an average for 500 years of observation (XV – XX centuries)

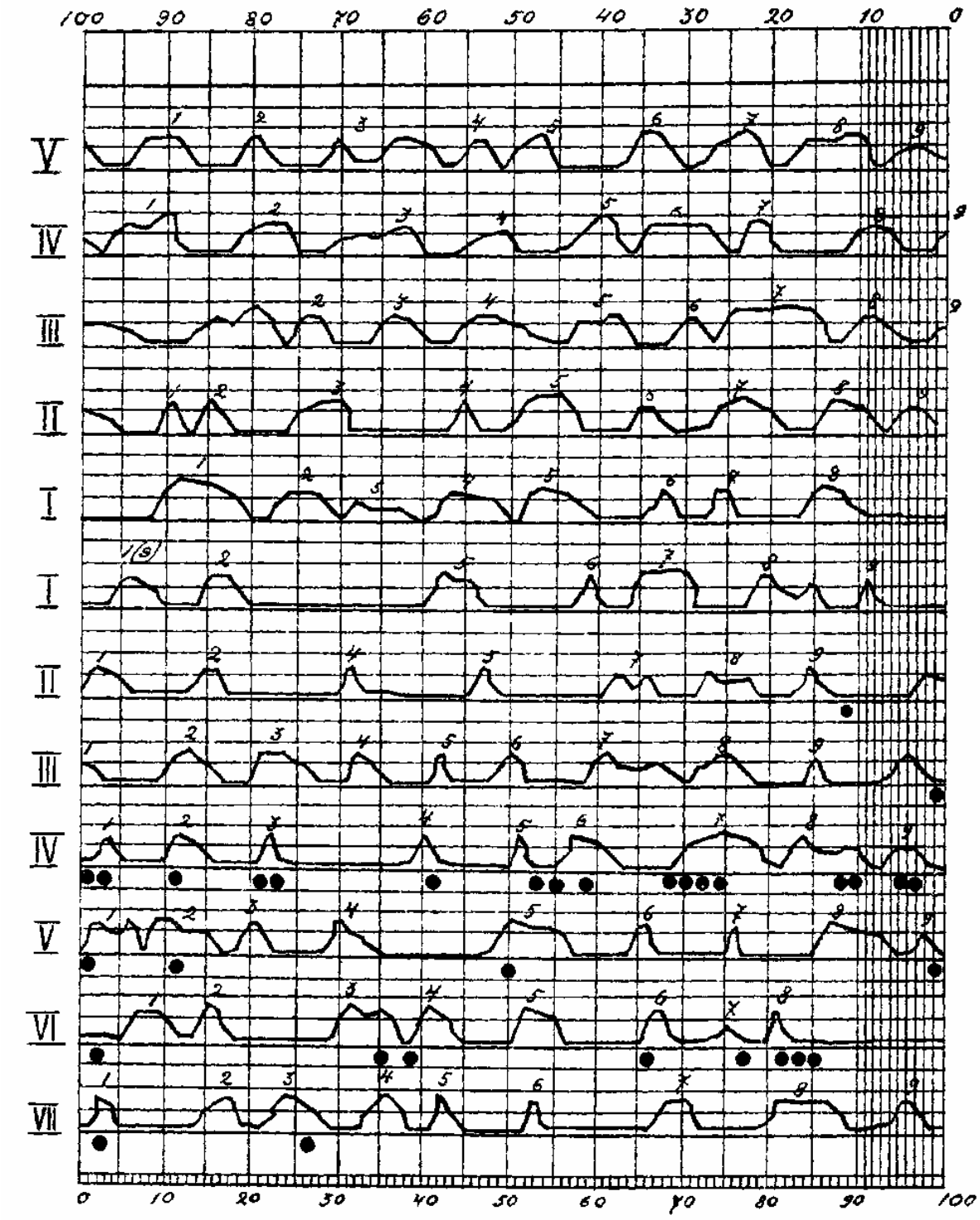

Fig. 2. The fluctuation's mean curves of the universal historical process on all the surface of the Earth during the period from V century B.C. till XX century A.D.

Along the abscissa axis are marked the years, along the ordinate axis – the quantity of important historical events. Dots mark the pretelescopic and later – astronomical data of the sun-spot maximum. Hyphens mark its minimum.

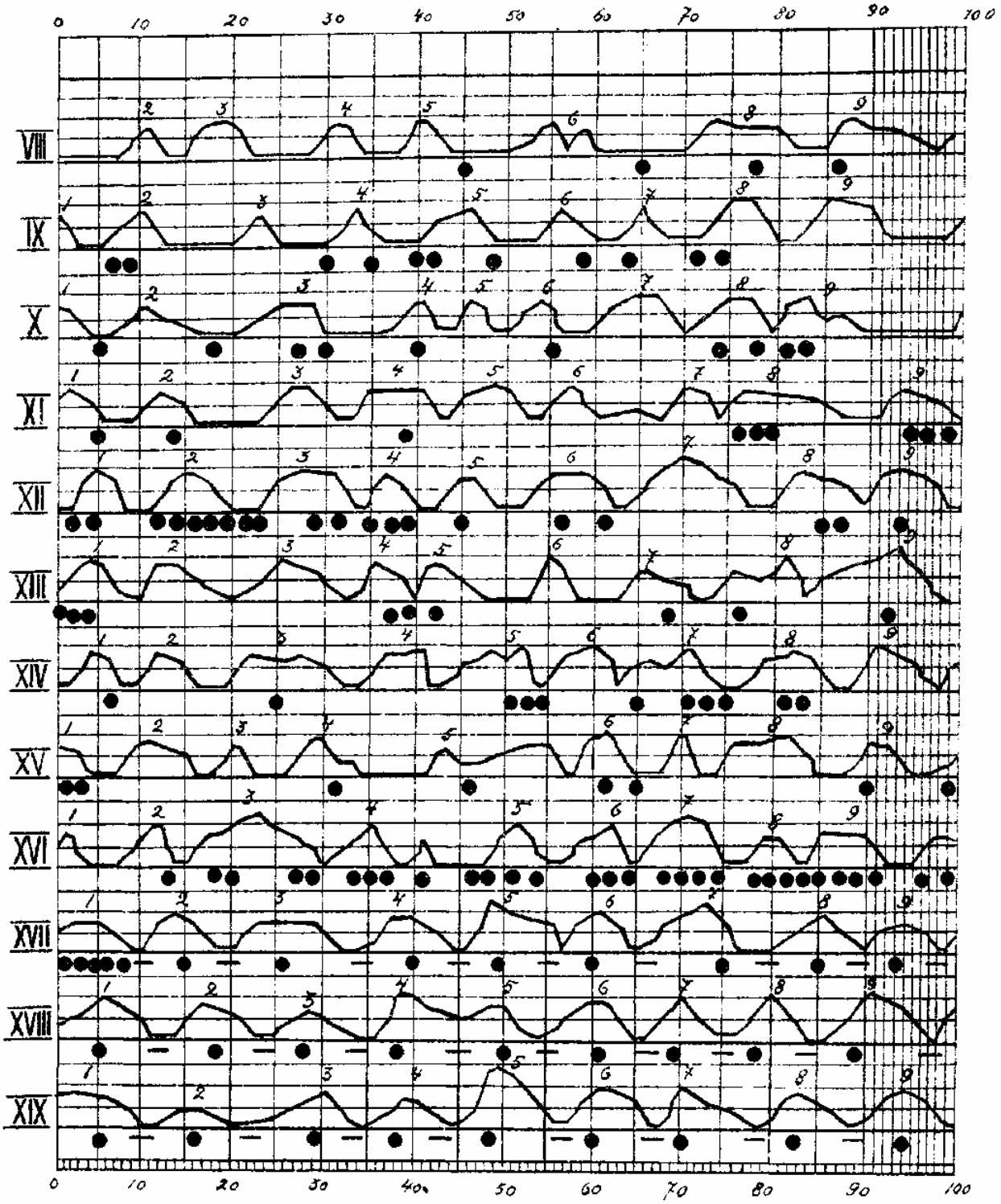

Fig. 3. The fluctuation's mean curves of the universal historical process on all the surface of the Earth during the period from V century B.C. till XX century A.D.

Along the abscissa axis are marked the years, along the ordinate axis – the quantity of important historical events. Dots mark the pretelescopic and later – astronomical data of the sun-spot maximum. Hyphens mark its minimum.

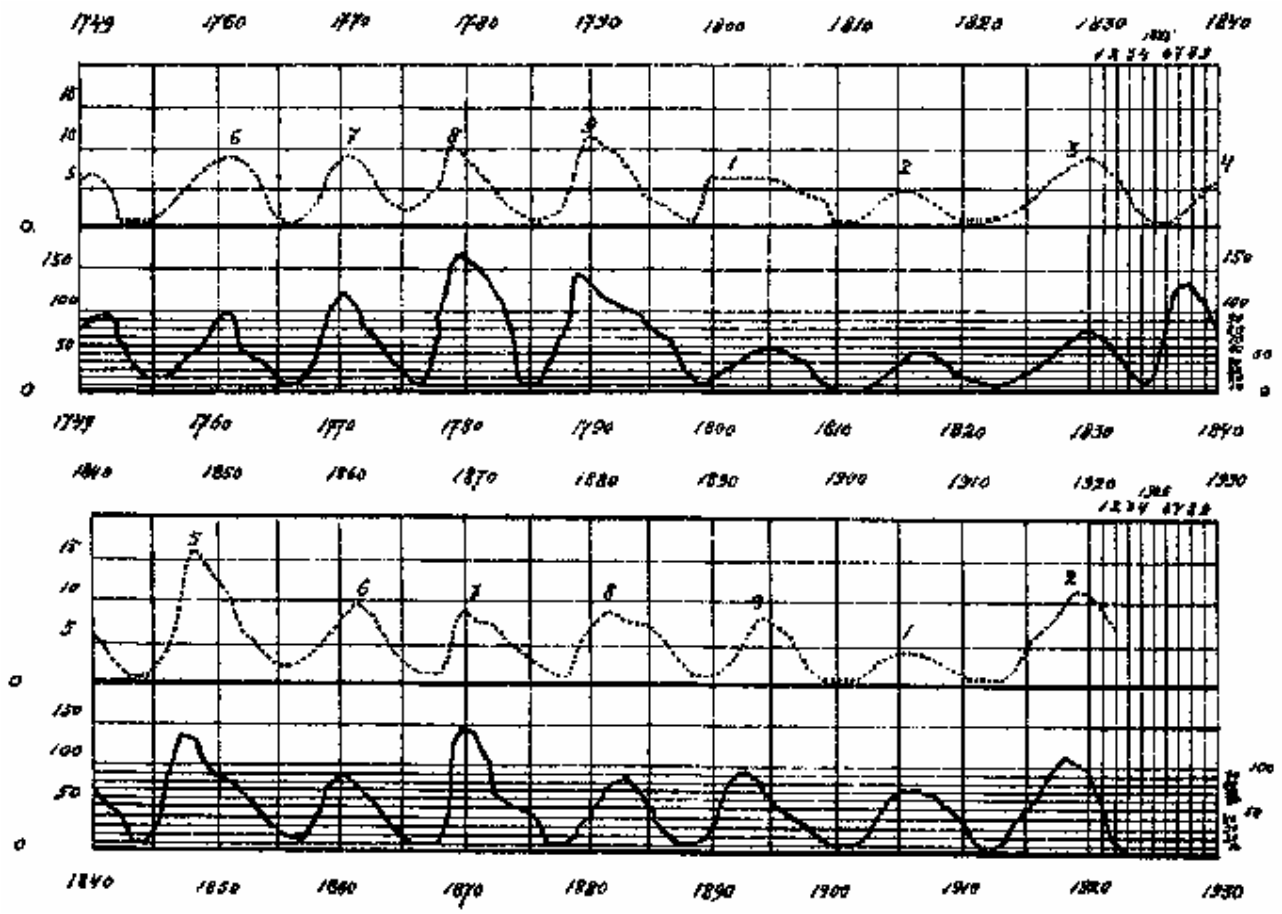

Fig 4. **Parallelism of the curves of sun-spot activity (below) and the universal human military-political activity (above) from 1749 till 1922**

SCHEMATIC SUMMARY OF PROPERTIES OF A COMPLETE HISTORIOMETRIC CYCLE

Sunspot activity	SA cycle Duration	11.124 Year, in the arithmetic mean			
	Duration of phases	← 5.16 Yr →		← 5.96 Yr →	
	Phase #	I	II	III	IV
	Sunspot number	**Minimum**	**Gradual increase in sunspots and their groups**	**Maximum**	**Gradual decrease in sunspots and their groups**
Social activity of human masses	**Historiometric Cycle (HC) duration – 11 years (in the arithmetic mean)**				
	Phase duration	**3** (in average)	**2** (in average)	**3** (in average)	**3** (in average)
	Phase name	**Minimal Excitability** (Epoch of relaxation)	**Growth of Excitability**	**Maximal Excitability (concentration)**	**Decline of Excitability**
	Rate of originations of historical events	**Minimal** number of originations of social movements of masses	**Gradual increase** in number of such movements	**Maximal** number of originations of social movements of masses	**Gradual decrease** in number of such movements
	Per Phase	**5 %**	**20 %**	**60 %**	**15 %**
	Per year	**1.7 %**	**10 %**	**20 %**	**5 %**
	Socio-psychological behaviour of masses per HC phases	Differentiation of masses, apathy to social matters, peaceable disposition of masses, tractability, tolerance, depression, static character of masses	1. Rise of social order ideas in masses and onset of collective concentration. 2. Grouping of ideas and masses. 3. Appearing of one prevailing idea and general consolidation of masses	I. a. Masses are influenced by Popular and military leaders, speakers, press; b. Effectuality of ideas being circulated in masses. II. a. Swiftness in development of popular movements; b) increase of territory sweep; c) integration of masses; d) individualization of collectives; e) high dynamics of masses	Progressive slowness of social reactions to irritations. Degradation of concentrated action, enthusiasm, inspiration, etc.
	Note		These phenomena are developed provided that political, military or other exciting factors are present in the society		
	Historical events per Cycle Phases	Making peace pacts, not large-scale aggressions, surrenders, occupations, maximal reduction of parliamentary rights, strengthening of autocracy	Hesitation in solving of military and political questions; preparations to war; worsening of international relations; initiating of conspiracies; exposure of military-political tendencies	Moving forward of popular and military leaders, statesmen; triumph of ideas that were supported by masses; maximal raise of parliamentary rights; democratic and social reforms; democracy, constraining of autocracy. Revolutions, rebellions, mutinies, wars, expeditions, campaigns, emigrations, campaigns, persecutions and other outbursts of large-scale people's activity	Disintegration of military and political organizations; separatism; rejection of claims of state or international level; dispersal or breakdown of popular assemblies; popular uprisings are quelled easily; completion of events that arose at the previous phase

5.3. A SKETCH ON SCIENTIFIC BIOGRAPHY OF ALEXANDER TCHIJEVSKY

(February 8, 1897 - December 20, 1964)

Eight years of WWI, Revolution (1917) and Civil War (1918-1921) have killed the Russian economy. This forced the bolsheviks to allow private property for a decade (this period was called NEP – New Economic Policy). Though they tried to introduce their bastard ideology in every sphere of life from the very incipient revolt, they had neither enough administrative forces, nor recruited scientists, nor time for achieving this goal in the twenties.

Just at that time, a graduate of Moscow Archeological Institute and Moscow Commercial College, Alexander Leonidovich Tchijevsky (or Chijevsky), had started to establish contacts between history, Mathematics and Biology: having been inspired by his ideas, he prepared his thesis on "Analysis of Periodicity of the World Wide Process" in search of a PhD in World History at the Scientific Council of the History and Philology Faculty of Moscow University in 1918.

His work received a positive approval from the official opponents, famous historians, who had carefully studied the thesis. Due to the extremely unusual subject of his thesis the members of the Council were in doubt, but they concluded that they were dealing either with a great delusion, or with an ingenious discovery and, in order that the progeny should not accuse them of a fateful error, they adjudged him a PhD since with respect to his professional maturity (according to the work done) A. Tchijevsky deserved this degree.

In 1922 he made a report on the discovery of the effect the periodicity of sunspot activity exerts on the rise and spreading of epidemics, which expands the concepts of his PhD thesis by taking into account the electromagnetic factors of influence.

These two discoveries were first published in 1600 copies, with sufficient details, in1924 [2].

Prof. Tchijevsky is not the first who noticed a correlation between the periodicity of sunspot activity (Solar activity, SA, in our days), food prices, etc. But he was the first who (1) discovered the synchronism between the SA cycles and social processes, (2) proposed a systematic forecasting approach that was based on this synchronism, and (3) assumed the electromagnetic and corpuscular origin of influence the Sun exerts on people, while considering the sunspot index as an admissible indicator of SA level. On these grounds he was the first in modern science, to put forward the concept that the fate of mankind depends on the fate of the Universe and calls upon the disclosure of the Solar effects on biological subjects and psychics from the viewpoint of physics and chemistry. Thus, he wrote: "Let us not restrict our thinking to the bounds of the Solar System but avow that other Space forces cannot be excluded from the forming of large-scale effects in society, in this or that way, even if they are unknown due to our ignorance."

He called this 72-page work a short sketch. But the results of his researches in full, relevant to Solar activity and history were not published any more in the USSR, even after his death. Only after the revolution of 1991, they came into life [3]. Publication of [2] made him a world famous scientist, but a pariah as well – mostly by soviet authorities. In this state of outcast and misery he lived until the end of his life.

Perhaps because it was hardly possible, if not hazardous to life, to continue to attract attention to his historical discoveries in the time of the Lenin/Stalin terror, that he concentrated his attention on the other, biological, side of his discovery by continuing his researches in the direction of heliobiology, viz. on physical and chemical effects the Solar radiation exerts on biological subjects.

However, in spite of the fact that after the publication of [2] he was officially engaged in air-ionization, not in historical studies, the resonance that was induced by this work had never stopped. He was commanded to officially repudiate the results of his long-term investigations, to repent and publicly to desecrate and abandon his work. In particular, this demand was recorded in the minutes of the Agriculture Academy of USSR. But he refused to do this.

In the twenties, Stalin's repressive power was not as almighty as at the end of thirties. Besides, to some extent NEP had weakened the ideological press in the twenties. Perhaps this was why a rare soviet leader was able to stand up for his own opinion not in corroboration with that of the party's. One of them was the first soviet minister of public health, N. Semashko, whose support of researches being conducted by Tchijevsky and editing of the latter's manuscripts had drawn Stalin's dissatisfaction. But in a private meeting with Stalin, Semashko had upheld the concepts of Tchijevsky and, for some time, the latter was left alone.

Since 1918 Tchijevsky studied the separate elements of a possible Sun-Earth interaction mechanisms. His primal attention was devoted to the problem of ionization of air. At his own miserable expense, he arranged a laboratory at home. At the end of 1919 he received the first results that were reported in Kaluga Society for the study of Nature which were then sent to a number of scientists in Russia and abroad. You can imagine his pleasure when he received a reply from Nobel Prize laureate S. Arrhenius who invited Tchijevsky to continue his studies at his laboratory. But he was not allowed to take this proposal; moreover, he became unemployed as he was required to give up all his jobs before going abroad.

In 1923 Tchijevsky managed to take a job at a zoological laboratory being headed by V. Durov, where he studied the influence air-ions exert on people and animals, until 1931. The results of his work on air-ionization and space biology were highly appreciated in Europe and USA. For his work in heliobiology and Solar activity cycles, he was elected to Toulon Academy of Sciences. He was invited to have a lecture course on biophysics at the Columbia University in NY. In appreciation of his work on air-ionization, the soviet government established the Central scientific-research laboratory on air-ionification, and he was appointed head of this lab. Professor Tchijevsky worked there for 11 years and published dozens of articles devoted to this subject. In particular, he paid much attention to the practical implication of air-ions in poultry farming, dyeing industry, and medicine. He invented a device for the ionization of air in premises that is now known as the Tchijevsky's chandelier.

Meanwhile, if in 1931 one of the basic soviet official newspapers, "Izvestia" qualifies his experimental results as "a brilliant achievement of soviet science that opens a new era in reconstruction of animal husbandry", in 1935 the sentinels of bolshevik ideology took over and the principal communist party newspaper "Pravda" dedicated an article to him: "An Enemy Under a Mask of Scientist" that was followed by a series of denunciations the profound sense of which is seen from their titles – e.g.: "infinite impudence of mock-professor Tchijevsky". However, though such a "disclosure" in those days was a sign of inevitable arrest and imprisonment, he was not repressed. Why? Why a scientist being dismissed from all his jobs and marked by this fiend label has lost his lab, but not freedom? Those, who knew him, attribute this phenomenon to his virtually world wide fame.

At the end of twenties, Stalin shut down NEP. Since then, the concentration camps established by Lenin began to swell with farmers, businessmen, and scientists who ventured to have their own point of view. However, though the Lab was closed, he continued to work at home (in those days any private establishment was absolutely prohibited). But from 1931 to 1959 his works were not published in the USSR (except for a scientific report on epidemics in 1934), though his articles were still published in Europe until 1936.

In 1939, the First International Congress on Biophysics and Space Biology was opened in New York where four honorary Presidents were elected, and Prof. Tchijevsky – among them. Already at that time it was acknowledged that he disclosed definite mechanisms of resonance between the live cells and Earth's biosphere with the mighty resonator – the Sun, through the electromagnetic and corpuscular Solar emission. No reason is seen except that this international support and acknowledgement of his scientific results, had postponed his inevitable fate of imprisonment until 1942.

It is really amazing that a scientist, who not only ventured to state but even to support a PhD thesis pertaining to Solar activity effects on the minds of people, had remained out of prison for such a long period of time. As in the state of triumph of terroristic ideology his work [2] not only shows that bolsheviks succeeded with the revolution of 1917 not due to the trustworthiness of the "Lenin-Stalin" ideology, but to a greater degree – due to a successful use of large-scale psychosis in the circumstances of war and economic dislocation around the Solar activity maximum in 1917. The more so as the large-scale sharpening of terror and imprisonment started around the Solar activity maxima in 1928 and 1937, in close correspondence with Tchijevsky's forecast.

In 1942, the so-called "Special Trio" – an extrajudicial organ of security services had sentenced him to imprisonment in a concentration camp and to subsequent exile. In essence, he was doomed. He refused to wear a large camp number over the back, objected to being treated with familiarity, and he stuck up for a sick man... . Hardly alive, he was removed from a punishment cell, only after the authorities were reminded that he was a biologist and could help with the typhoid epidemic that struck the camp. It was necessary to stop it by improvised means, such as bleaching powder etc. He succeeded in doing this.

As a reward, he was permitted to organize a kind of clinical laboratory (!) at the camp hospital, where he studied some aspects of moving blood being important for military medicine. Fifteen years later, by a directive of the President of Academy of Sciences of USSR, the Academy issued a Tchijevsky's monograph: "Structural analysis of moving blood", the experimental basis for which was obtained at "clinical laboratory of Saviour (by the name of nearby church) hospital". In this monograph Tchijevsky writes: "Complete verification of the theory requires special equipment. However, its basic principles were acknowledged in 1948-1949 by experiments that required almost no equipment except for microscope and glass capillaries. Subsequent mathematical analysis has allowed him to form the principles for the description of the observed phenomena". The witnesses add that that microscope was the only one, and the camp commander set a courier several times to Moscow for reagents and laboratory animals for the convict scientist.

On January 22, 1950, Tchijevsky was discharged, but he refused to leave the camp (!) as he had not completed an important experiment. In 33 days, the result was obtained, and with permission to take his scientific archive, he obtained his "freedom": to go into exile in the Ural mountains and Kazakhstan, where he lived until he was rehabilitated. Prof. Tchijevsky continued his researches there in hemodynamics and air-ionization, implemented the results of this work at several coal mines in Karaganda coal basin and, after that – in Moscow, he implemented an air-ion-therapy at several hospitals.

In 1958 he returned to Moscow, together with his wife, who also had come through the camp's wretchedness, in a tiny one-room flat. But the inter-shelf space in that room was filled with the bright sunny landscapes by the brush of Tchijevsky, who was also a poet and lover of theatre.

His monograph "Air ionization in national economy", in 1960, for a long time contained the most fundamental description of the subject. In meteorology and other Earth sciences as well, he overturned the "Geocentric" approach in the study of various Earth's phenomena by taking in account the Solar and other Space factors of influence.

He went to the better world on December 20, 1964. And three days later the governing communist party, by the hand of one A. Erochin, had summarised his life and scientific achievements in a party journal under the title of "Black Spots". This bouquet for the scientist's coffin states: "Tchijevsky explains all the paramount events in the history of mankind, including the Great Revolution of 1917 and the activity of Lenin, by a mass psychosis, as if it arises as a result of sunspot activity…", and resumes with "inconsistency and damage arising from this "scientific balderdash" …".

However, a series of progressively thinking scientists and journalists, L. Golovanov and A. Lebedinsky among them, had decided to defend the name of the late scientist. They strived for a creation of a Commission on the scientific heritage of professor Tchijevsky at the Institute of Technique and Natural History of Academy of Sciences of USSR. And already 3 months later, in March 1965, the same journal published the full text of the conclusion of this Commission (by the opinion of the author of [1], this is the first case in the soviet press, when the refutation of lies took more place than the lie itself.).

But 25 more years had passed before Tchijevsky's scientific works devoted to Solar activity were published in Russia in full. After the first publication of his small-circulation sketch [2] in 1924, it was reviewed in a popular journal "Chemistry and Life" in 1989-1990, and, after that - as a full copy of [2] with a circulation of 100 000. Only in 1995, his fundamental 768-page monograph [3], with all required statistics and references, was issued. Its first, basic part: "The Earth in the Embrace of Sun" (600 pages) was written in 1929 – 1930. Other works also either were not published, or disappeared, such as "Heliotaraksia", of which none of the 200 copies is accessible in Russia now.

Of course, most of the references to physical effects in [3] have become out of date, and new statistics and physical effects are found due to a fantastic growth of possibilities with which electronics and space flights now present us. But all these results either support, or develop the basic concepts that were put forward by Tchijevsky a century ago.

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Compiled by S. Smelyakov

5.4. THE GOLDEN SECTION DISTRIBUTION OF SIGNIFICANT HISTORICAL EVENTS OVER THE SOLAR CYCLES

In compliance with Tchijevsky's data [2] covering the time interval from the 5th century BC to XIX century, we obtain that the quantity n_k presenting a number of years in a century k which are marked by significant historical events, takes the values being close to Fibonacci numbers and the terms of the series $\boldsymbol{z}$ (Table 5.1); at this, an absolute error of deviation of values n_k ($k = 1, 2, ..., 24$) from the nearest values u_i, v_j is quite small and equals to $\Delta = 1.7$ yr (with the exception of the XVIII century data, $n_{18} = 65$), while the respective relative error is about 3%.

It is interesting, that Tchijevsky put the question mark at number *23* (for the 2nd century BC), though in the context of the considered Model the more questions could call the number 65, the appearing of which might probably be explained by definite subjectivity in evaluating the XVIII century being stormy on events, other things being equal. Hence, high accuracy of n_k distribution over the terms of the series $\boldsymbol{z}$ is also can be taken as the argument for the ATS.

Table 5.1. Distribution of the value n_k (number of years within a century which manifest significant historical events) over the united Fibonacci series $\boldsymbol{z} = \boldsymbol{u} \cup \boldsymbol{v}$

Terms of series u_i, v_j	n_k values (for the sample of 24 centuries)	Average, $\bar{n}_k$	Deviation of n_k from z_i, $\Delta_i = \lvert n_k - z \rvert$, $z = \{ u_i \text{ or } v_j \}$
$u_8 = 21$	23	23	2
$v_7 = 29$	27, 28, 28, 29	28	2, 1, 1, 0
$u_9 = 34$	32, 36, 37, 37	35.5	2, 2, 3, 3
$v_8 = 47$	44, 45, 47, 49	46.3	3, 2, 0, 2
$u_{10} = 55$	52, 53, 53, 54, 56, 56, 56, 57, 58	55	3, 2, 2, 1, 1, 1,1,2,3
$v_9 = 76$	76	76	0
$u_{11} = 89$	86	86	3
		Average = 1.7,	$\delta \approx 3\%$

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